**Sri Lanka Tsunami Reconstruction Program** (SLTRP)

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# Fisheries Management Action Plan

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CH2MHILL

*In association with Chemonics International, DEVTECH, FNI, Engineering Consultants LTD., EML Consultants, Lanka Hydraulic Institute, MICD and Uni-Consultancy Service*

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The author expresses his appreciation for the assistance of all of these helpful individuals and agencies.

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| CCD | Coastal Conservation Department |
| CEY-NOR | Foundation within MFAR |
| CFC | Ceylon Fisheries Corporation |
| CFHC | Ceylon Fisheries Harbor Corporation |
| CSW | Chilled Sea Water |
| DCS | Department of Census and Statistics |
| DFAR | Department of Fisheries and Aquatic Resources |
| EDB | Export Development Board |
| FRDP | MFAR/FAO Post-Tsunami Fisheries Reconstruction and Development Programme |
| FRP | Fiber-Reinforced Plastic, leads to slang word "FAR-pee" denoting fiberglass boats generally of six to seven meters in length and commonly powered by an outboard motor |
| FAC | Fisheries Advisory Council |
| FPQCU | Fish Product Quality Control Unit of MFAR |
| GoSL | Government of Sri Lanka |
| HACCP | Hazard Analysis Critical Control Point |
| hp | Horse Power |
| MALLI | Ministry of Agriculture, Livestock, Lands and Irrigation |
| MENR | Ministry of Environment and Natural Resources |
| MFAR | Ministry of Fisheries and Aquatic Resources |
| MPEDA | (India) Marine Products Export Development Authority |
| MT | Metric Ton |
| NARA | National Aquatic Resources Research and Development Agency of MFAR |
| RSW | Refrigerated Sea Water |
| SEA | Seafood Exporters Association |

# EXECUTIVE SUMMARY

This Fisheries Management Action Plan was developed as a component of the USAID Sri Lanka Tsunami Reconstruction Program (SLTRP), and was directed toward development of recommendations to improve the fisheries value chain while promoting responsible stewardship of coastal resources. The effort was focused on the fishery harbors at Dondra, Mirissa and Hikkaduwa, which are scheduled for reconstruction within the SLTRP, but recommendations are not bound by the SLTRP scope of work. Wider ranging recommendations are also provided in the hope that they will be advanced by interested parties. This program also provides opportunities for timely implementation of certain highly visible, practical and tangible improvement projects.

Two areas of fisher activity presenting the most immediate potential for significant improvements in fishery value are the handling of fish at sea and management of vessel turn-around time in the fishery harbors. Both relate to operation of the offshore multi-day fishery, which provides greater potential for growth than does the coastal one-day fishery.

Multi-day vessels routinely return to port with 20 to 60 percent of their catch in degraded states depending on the duration of the voyage, sea state and other variables. The high quality fish sells at auction for prime fish prices, while the degraded portion of the catch sells for one-half to one-third of the prime price and is processed as dried fish. Elimination of damage to the catch will allow the entire catch to sell at the prime price, resulting in very substantial increases in value of the catch and in fisher income. Recommendations are provided that may reduce if not eliminate these levels of damage.

Many fishers are disturbed by the time required to unload and reprovision their vessels at the fishery harbors. The average vessel turn-around time is said to be seven or more days. Tasks involved are unloading and sale of catch, refueling, resupply of potable water and groceries, net repair, and obtaining and loading ice. Delay in turn-around causes congestion in the ports, which in turn causes further delays. A vessel making eighteen ten to 14 day trips per year, for example, now spends approximately 18 weeks annually in harbor between trips, and if this time could be halved, for example, the vessel would potentially add nine weeks of fishing, or more than 25 percent, to its annual capacity, raising incomes of owners and fishers. Recommendations are provided that will potentially decrease vessel turn-around time in the Dondra, Mirissa and Hikkaduwa fishery ports.

Optimizing the value of changes will also require some modifications in fisher operational behavior, motivating recommendations for extension training and for strengthening fisher stakeholder participation in sustainable harbor and fishery management. Effective stakeholder participation also provides potential for activism improving fisher welfare and well being.

The one-day coastal fishery presents different challenges in that the fishery was already evaluated as over-exploited before the tsunami. NGO boat donations are said to have exacerbated this issue by creating more fishing boats than existed prior to the disaster. In order to increase fisher income the catch per unit effort trends must be reversed, which implies that entries into this fishery should be reduced rather than increased. Suggestions are made concerning approaches to this difficult issue.

Fisheries management issues in Sri Lanka should be approached with some urgency. Sri Lanka's total domestic fish and seafood consumption in 2002 was 361,000 metric tons, providing for a *per capita* consumption of approximately 19.0 kilograms. Fish contributed nearly 65 percent of all animal protein consumed. Current GoSL policy calls for increasing the *per capita* consumption to 25 kilograms, which will raise the percentage of animal protein being supplied from the sea even higher. Considering the forecasted growth in population, raising the *per capita* consumption to 25 kilograms will require an additional supply of 154,000 metric tons (MT), an increase of 43 percent, which must be supplied by domestic catch or imports. The importance of fisheries to the welfare of Sri Lankan society clearly warrants close attention by resource managers and development agencies.

# SECTION I: OVERVIEW

## 1.1 PROGRAM BACKGROUND

The Sri Lanka Tsunami Reconstruction Program (SLTRP) was implemented in response to devastation inflicted by a tsunami that swept more than 700 miles of Sri Lankan coastline on December 26, 2004. In addition to physical reconstruction components, the program includes technical assistance activities related to vocational education and participatory coastal management (PCM). A component of the PCM component is an evaluation of fisheries at Hikkaduwa, Mirissa and Puranawella (Dondra) harbors, focused on "building better" through community participation and improving institutional capacity. This task calls for identifying opportunities and options for improving the value chain of both small and large fisheries while promoting responsible stewardship of coastal resources. This resulting Fisheries Management Action Plan also provides guidance on the physical infrastructure recommended to be built at the Hikkaduwa, Mirissa and Puranawella Fishery Harbors under the construction management component of SLTRP, and provides input into development of harbor master plans for these three locations.

Recommendations presented here are made in recognition that some may fall outside the existing scope of work of SLTRP. Some recommendations can be incorporated into the existing program, but others may not be accommodated. They are nevertheless presented with the expectation and hope that interested parties will elect to advance them.

## 1.2 IMPORTANCE OF FISHERIES IN SRI LANKA

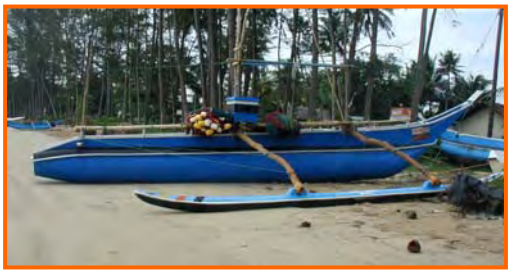
Fish contribute nearly 65 percent of all animal protein consumed in Sri Lanka (DCS 2005). In 2002 the annual *per capita* consumption of seafood was 19.0 kilograms requiring a total supply (production plus imports) of 361,000 MT (USAID 2005). Population growth forecasts indicate that this rate of seafood consumption will require an increase of 30,000 to 391,000 tons by 2015 (USAID 2005). Current Government of Sri Lanka (GoSL) policy calls for increasing the *per capita* consumption of seafood from 19 to 25 kilograms (S.A. Sahabandu, *personal communication*), however, which will require a total of 515,000 MT to satisfy. This represents 154,000 MT more than the 2002 supply, an increase of 43 percent The rising need for high quality seafood will clearly create management and operational challenges in an already strained system, requiring ever greater efficiency and attention to product quality while protecting the resource upon which it is founded.

## 1.3 FISHERY HARBOR USE

In response to needs for adequate fish landing and fish boat servicing facilities, the GoSL has constructed 15 fishery harbors since 1972, of which 13 are operational. Most of these are managed by the Ceylon Fishery Harbours Corporation (CFHC), including the three at Puranawella (Dondra), Mirissa and Hikkaduwa. These harbors are variously equipped

with fuel and fresh water dispensing facilities, fish auction floors, net repair facilities, ice availability, canteens, dock space, and other amenities required for servicing fishing craft and crews, and they are of various sizes with variable capacity for accommodating user boats.

Several sizes and types of boats utilize these facilities, including motorized and non-motorized traditional small craft (*oruwa*) frequently rigged with outriggers, six to seven meter long fiberglass or FRP [pronounced "FAR-pee"] boats powered by outboard motors, 3½ ton diesel inboard boats [termed three-and-a-halfs (*sic.*)], and larger diesel inboard multi-day offshore boats.



**Traditional Canoe**

**Two FRPs in foreground**

Traditional craft generally fish coastal areas, with a typical trip lasting about 12 hours: three hours out, six hours fishing, and three hours return. They usually depart in the late afternoon to fish through the night, and arrive at the fishery harbor in the early morning to sell their fresh catch to local consumers and wholesalers. FRPs often fish along with traditional craft, but they are capable of venturing a bit farther offshore, up to about 15 kilometers, and of remaining on station for longer periods.

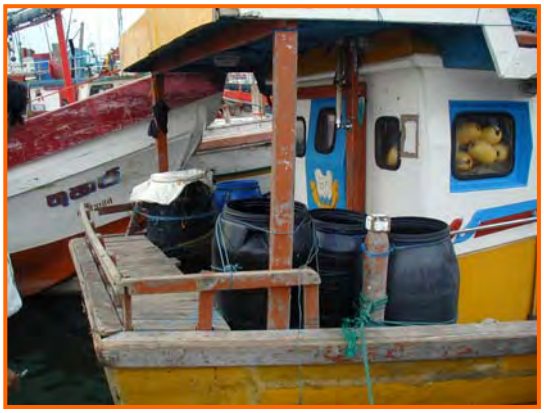
The 3½-ton vessels are capable of venturing even farther offshore and have sufficient power to utilize additional fishing methods, such as large-mesh gill nets, long-lines, and purse seines. They are built without ice holding facilities, however, so they must operate as one-day boats unless custom-modified with an ice hold installed after purchase. These modified vessels are referred to as "tank boats" (*tanki boattu*).

**3 ½ Ton Inboard Diesel**

**Offshore Multi-day Vessel**

Multi-day boats are up to 50 feet long with engines greater than 50 horsepower, and are equipped with ice holds (usually two), fuel tanks, and water tanks. Potable water is frequently also carried in drums secured on the aft deck. These are genuine deep sea fishing vessels venturing on trips of ten days to four weeks, depending on target species, fishing methods, and intended fishing grounds. They generally utilize long-lines, drift gill nets or purse seines.

## 1.4 PROGRAM VISIBILITY



**Water Barrels**

During discussions with members of local fishing communities it was sometimes evident that a degree of frustration exists with the donor community, in that fishers and their families have observed numerous foreign data-gathering teams, spoken with some and have been told about assistance projects in their near future. A year has passed, however, with little tangible change or assistance from their immediate perspective, creating some reluctance to invest their time in unfruitful discussion with new aid workers. Most remain hopeful and eager to participate, but it is clear that implementation of immediate, visible, practical and tangible – even small – projects will create beneficial results out of proportion to their relatively small cost. Throughout this document, therefore, the task and project recommendations that may potentially respond to this opportunity are identified by an asterisk over the recommendation's identifying number, with the expectation that they will be of interest to aid institutions.

# SECTION II: FISH HANDLING AT SEA

Product quality issues associated with fish handling at sea are primarily associated with the multi-day fishing fleet, which uses large amounts of ice to chill its catch. The typical multi-day vessel has two insulated holds, both of which are completely filled to the top in preparation for leaving port, although some space may be left in one of the holds to keep groceries. When the first day's catch is brought aboard, most of the ice in one of the holds is removed by hand and stored on deck. The fish are then placed at the bottom of the hold, and the ice on deck is replaced in the hold. The next day, ice is again removed, fish placed into the hold, and the ice is again replaced. This process continues until the hold is full from bottom to top with fish and ice.

As a result of this procedure, the first – or oldest – fish caught are stored at the bottom of the hold, with the weight of other fish and ice weighing down upon them for the remainder of the voyage. Ice melt and fluids also collect in the bottom of the hold. The quality of some of these fish degrades by being stored in a less than optimal environment, and the quality is further degraded simply by being crushed by the weight above.

When the vessel arrives in port, the most recently caught and highest quality fish stored in the upper parts of the hold sell for the higher prime fish price, while the lower quality fish from the bottom of the hold sell for a lower price, typically for one-half to one-third of the prime fish price. These fish are destined for the dried- rather than fresh-fish market. Estimates of the percentage of catch selling for the lower price vary, with different owners providing different estimates, ranging from 20 percent to 60 percent. Estimates of 30 to 50 percent are most common.

If the damage to the first-caught fish can be eliminated so that all fish in the hold can be sold at the prime fish price, it would have the effect of increasing the value of the catch without having to catch additional fish. For example, if the price of the damaged fish is one-half the price of the prime fish, and if 40 percent of the catch is normally damaged, then elimination of this damage so that all fish can be sold at the prime price will increase the value of the catch by 25 percent. Under the same conditions, if the price of the damaged fish is one-third of the prime fish price, then the value of the catch will increase by 34 percent.

These very significant numbers merit attention. Elimination of this damage, or "waste," will increase earnings of multi-day boat owners and crews by 25 to 34 percent, assuming 40 percent damage. Table 1 provides comparable estimates for other normal damage rates.

## 2.1 FISH HANDLING ALTERNATIVES

Development of low-cost and readily implemented improvements aimed toward eliminating the damage commonly occurring in the holds of multi-day boats is clearly a

high priority for improving the value chain of Sri Lankan fisheries. All fishermen, boat owners, and government officials interviewed during this effort were unanimous in the

**Table 1.**
**Rise in Value of Catch if**
**Hold Damage to Fish is Eliminated**

| Price of Lower Quality Fish | Normal damage ("waste") rates | | |
|---|---|---|---|
| | 30% | 40% | 50% |
| ½ of Prime Price | 18% | 25% | 33% |
| ⅓ of Prime Price | 23% | 34% | 46% |

opinion that the domestic retail market will easily absorb the resulting increase in high quality fresh fish.

Several alternatives may be pursued, but some may be more readily implemented than others. Conversion to use of plastic fish boxes to store catch would be effective, but will likely require significant alterations in hold configuration and entail significant expense. Freezing fish at sea is possible, but inexpensive dependable mechanisms appropriate for Sri Lankan multi-day boats have not yet been developed. Brine and refrigerated sea water systems provide potential approaches, but they will entail significant development and equipment costs (USAID 2005, app. A).

Other approaches may be more readily implemented, and are discussed below.

### 2.1.1 Hold Shelving

Shelving in fish holds is routinely used in other fisheries, such as the North Atlantic swordfish fishery, to reduce the weight on underlying fish. In practice, first-caught fish are placed in the bottom of the hold with ice, and a shelf supported by brackets on the sides of the hold is placed above them. Subsequent catch is placed and iced on the shelf so the new weight will be held by the shelf, preventing the weight from pushing on the earlier catch stored below. Several layers of shelves may be used.

This method would require minimal alterations to existing vessels. It would merely entail installation of shelf brackets on the sides of the hold, and a deck area to store pre-designed and fabricated fitted shelves to fit the brackets. The shelves may be designed with holes or slats allowing drainage of ice melt and fish fluids. A low shelf at the bottom of the hold may also be designed to hold the first-caught fish while supporting them above the ice melt and waste in the bottom of the hold.

### 2.1.2 Quick Slurry Chill

All cooling methods require time to completely chill fish, and larger fish require more time to chill than do smaller fish. Fish placed directly on ice are chilled, but in some

cases chilling is a bit slow for providing top quality product. A readily applied improvement is to quick-chill the catch in containers of ice-seawater slurry, containing more ice than seawater, but sufficient seawater to surround the fish. This allows the cold water to contact the entire surface of the fish, including inside body openings and the body cavity if the fish are gutted, chilling them more rapidly than ice alone.

Fisher interviews identified one fisher (H.W. Mahinda, *personal communication*) who has tried the shelving and quick slurry chill methods together. His approach was to chill his catch for 24 hour in an ice-seawater slurry, and then to store the chilled fish on ice in his hold equipped with shelving. Mr. Mahinda reported that he regularly returned to port with 100 percent of his catch selling for prime prices. Unfortunately his vessel was destroyed by the tsunami, and he has as yet been unable to replace it. It is unknown whether construction drawings for his vessel exist, but it was built and equipped with the shelving system by Blue Star Marine, who may have records.

## 2.2 CHILLER UNITS

Using a chiller or refrigeration unit to maintain catch quality would have numerous advantages. It would be especially advantageous for longer fishing trips of greater than 10 to 12 days, after which the efficacy of icing alone declines (USAID 2005). It would eliminate the need to carry a full load of ice, which is heavy and requires energy in the form of expensive diesel fuel to transport. Ice also occupies space in the hold, which could be used to hold additional fish if the need for the ice could be eliminated. It would eliminate the tedious and energy consuming labor required to empty and fill the hold of ice every day to store new catch. Finally, it would potentially free some hold space for redesign as fuel carrying capacity, thereby extending the range of the fishing vessel.

The CEY-NOR Foundation is working on development of a package chiller unit designed with 75 to 100 nozzles to spray chilled brine or seawater to refrigerate fish stored in the hold. It has also been tested to operate as a refrigerated sea water (RSW) system, in which cooled seawater is circulated through the hold. A more detailed discussion of this unit is provided by USAID (2005). The vessel on which this unit is installed on a trial basis is reportedly selling 100 percent of its catch at prime fish prices (K.D. Liyanaga, *personal communication*). The future of this experimental project is unclear, as organized follow up and data gathering appear to be languishing.

## 2.3 RECOMMENDATIONS

*Recommendation 2.1**
The use of hold shelving to preserve catch quality should be encouraged. The benefits of this approach should be the subject of extension training, which will likely encourage some entrepreneurial fishers to develop home-made systems for applying this method.

A concurrent demonstration program is recommended. Shelving design specific to the typical hold configuration of Sri Lankan multi-day boats should be developed by boat builders, CEY-NOR, NARA, or another interested entity. The system should be installed

in a typical vessel, either GoSL-owned or volunteered by an operating fisher. Results of fishing trips with records of waste elimination and resulting increases in trip revenues should be meticulously kept. Following sufficient trial to convincingly demonstrate the method's effectiveness, results, boat designs, and operating methods should be incorporated into fishery extension efforts to demonstrate the value of this approach to the fishing communities using the fishery harbors. If the approach proves to be effective, discussions should be held with major boat builders to incorporate hold shelving into standard boat designs.

*Recommendation 2.2**
The benefits of the Quick Slurry Chill method should be tested, perhaps by NARA, using comparison analyses in actual operating conditions. Comparable fish (size, species) from the same catch should be divided into separate treatment groups, with one group being stored directly onto ice, another being quick chilled before storage using traditional storage methods on ice, and a third group being stored using hold shelving. Their quality should be compared at the end of the voyage to determine whether the methods are helpful and to what degree. Results should be shared with fishers during extension efforts. As appropriate, testimonial from H.W. Mahinda concerning his successful use of these practices might be presented during extension exercises to bolster credibility among fishers.

*Recommendation 2.3*
Efforts to develop a chiller appropriate to Sri Lankan multi-day vessels should be refined and continued, preferably on an accelerated basis. The approach appears promising, and the longer it takes to develop, the longer the rate of waste in the fishery will be prolonged while the potential increased income for improving lives of the fishing community is deferred.

Many fishers are unaware of attempts to develop these chiller units. They should be informed of developments as they occur as a part of the fisheries extension process. Their enthusiasm may well provide stimulus for government or other support of these efforts.

As methods and equipment are determined to be beneficial and wise investments, financial assistance should be provided to fishers to enable rapid deployment of the equipment to operating vessels. Low to no interest loans or other subsidies would be helpful to the fishers, many of whom are already heavily leveraged on their equipment financing. Such assistance could be provided directly or through a Fishery Committee or Cooperative structure, discussed elsewhere.

# SECTION III: DOCKSIDE FISH HANDLING

Methods for handling fish at dockside in fishery harbors are not mechanized, are labor intensive, and are slow. Fish are seldom iced or otherwise cooled from the time they leave to boat until they are placed into trucks for transport.

## 3.1 BOAT UNLOADING

### 3.1.1 Unloading to Dock

Fish are unloaded from the holds of multi-day boats by hand one by one. The job is sometimes labor intensive, because ice in the hold is frequently fused and must be chopped to free encased fish. Space in the hold is limited, so this is close work. Fish are carried to the dock where batches of fish are weighed on scales.

**Unloading One-by-One**

**Dockside Weighing**

**Tuna Packed in Truck**

Multi-day boat owners frequently own their own transport trucks or have arrangements with established transporters or wholesalers, whose trucks may be parked on the dock directly adjacent to the boat. In this case, the landed high quality fish are then transferred directly to ice in the trucks. Poorer quality fish are piled either on the deck or dock to await sale to purchasers for fish drying operations.

When multi-day boats are rafted, the boat closest to the dock is usually the only one actively unloaded. In some cases, crew will carry fish or boxes of fish from the second boat over the deck of the first to the dock. This is clearly a labor intensive effort.

Multi-day boats are commonly rafted to a depth of four to six boats. The outer boats must therefore await their turn to unload. Those at the dock unload and vacate the space, which is then occupied by the next boat out. Unloading often takes three to four days from arrival at the port, affecting vessel turn around time as well as fish quality.

Boats without pre-arranged buyers or transporters transfer their catch to the dock or harbor auction facilities for auction sale.

**Unloading an FRP**

One day boats generally transport their catch in plastic or foam cooler boxes, which may or may not contain ice. Smaller fish are collected in these boxes which are lifted to the dock and carried to the auction area. Larger fish may be transferred singly by hand. These fish are generally of reasonably high quality, and the "one-day" boats are mostly in reality night boats that fish through the night and unload their fish at the dock at first light. Many of these fish are washed with unclean harbor water, however, rather than clean fresh or rinse water.

### 3.1.2 Transport to Auction Area

Covered auction areas consisting of concrete ground slabs are available at all three fishery harbors, but they seem to be seldom used. Most fish appear to be auctioned from the dock immediately adjacent to the vessels landing their fish. Few of these areas are supplied with fresh water. No sanitary amenities are available in these areas, although the occasional fisher will display his catch on a sheet of black plastic spread on the concrete in an attempt at cleanliness.

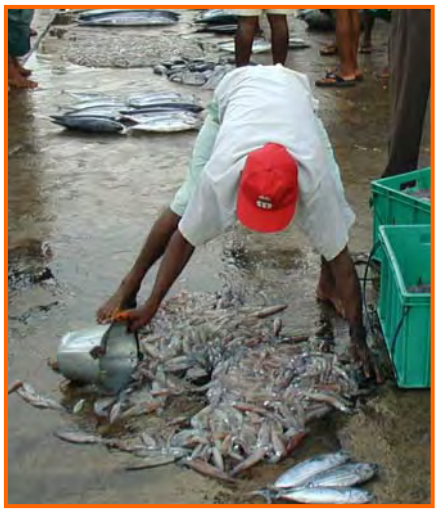
**Hauling Fish Rinse Water**

**Dockside Display**

## 3.2 AUCTION FACILITIES

Fisher interviews indicated that auction floors are not used because they offer little advantage to using the dock. It is easier to leave the fish on the dock near the boat as opposed to having to carry the catch by hand to the auction floor. Also, the auction floor is just that, a floor, similar to the dock, but of smoother finish. This smoother finish is said by some fishers to become

slippery when wet and when fish slime collects. No fish display tables, ice, or running water are offered in the auction areas.



**Gathering Squid**

**Plastic Sheet Sanitation**

**Working Fish Monger**

## 3.3 REGULATION OF FISH HANDLING

Handling of fishery products destined for export is regulated to conform with requirements of the European Union (EU) by Fish Products (Export) Regulations 1998, published under the Fisheries and Aquatic Resources Act, No. 2 of 1996 (USAID 2005). These regulations are administered by the Fish Product Quality Control Unit of the DFAR, which certifies health certificates and certificates of origin as required. Export fish processors also impose their own Quality Assurance and Quality Control in their own best interests, as poor quality product will lead to loss of customers and revenues.

The Food Act apparently contains standards of facility cleanliness and care, but is generally enforced only in hotels and restaurants. Handling of the bulk of domestic product destined for public consumption appears entirely unregulated and unsupervised, leading to unnecessary quality deterioration and spoilage.

Effective regulation of domestic fish handling and product quality will be very difficult to achieve within the immediate future. The existing fishery system is extraordinarily complex, with diverse and numerous product entry points, boats landing product in numerous coastal market and landing areas, beach seines landing fish on every coast, and traditional coastal fishers doing the same. Fish landed in all of these places are opportunistically sold on the spot at retail and at wholesale prices. They are distributed into local and national markets, with many passing through multiple market links. The lack of efficient control points makes enforcement of quality regulations – if they existed – very challenging. Consumer education may be the best hope for changing fish handling behavior leading to improved quality control within the near future.

## 3.4 RECOMMENDATIONS

*Recommendation 3.1*
Harbor managers should consider acquisition of small mobile cranes for unloading fish from boats at the dock. An appropriate crane would allow the second, third, and even fourth boat from the dock to be readily unloaded by lifting net or box containers of fish over the closer boats. Cranes could be self-mobile or run on tracks built onto the seawall.

*Recommendation 3.2*
A system for collection and transport of fish from dockside to an improved auction facility should be developed. A standardized trolley or tractor-wagon system would provide a simple and low labor means of transporting the fish, segregating owner lots, and facilitating transport to lorries and other transports. Care must be taken, however, that the system be appropriate to the needs and desires of users and harbor stakeholders. To assure user acceptance, needs should be assessed and systems selected and designed through a stakeholder participatory process implemented through a stakeholder group such as Fishery Committees, and mentored by experienced facilitators, perhaps from interested NGOs or aid providers.

*Recommendation 3.3**
Sanitary auction facilities should be provided, including display tables made of stainless steel or lined with plastic inserts for ease of cleaning. They should provide for drainage of ice melt and fish fluids, and the auction facility should be provided with ice to encourage proper handling of high quality fish (Please see Recommendation 8.5). Lines supplying saline wash water and flexible hoses should be installed to serve both ends of the auction floor. Runoff channels should be built into the floor and should empty into a waste collection or treatment system. Ice should be provided and managed by an interested user group or administrative entity, and be paid for from dock fees, Fishery

**Dondra Auction Floor**

Committee income, allocations from boat registration fees, or some combination of these or other levies (see Recommendation 8.4). Ice at the auction area should not be a direct cost of individual fishers or boat owners, which would encourage uneven use and therefore uneven product quality standards through the auction place, which is a "common area," used by all. Management of ice distribution and daily cleaning and maintenance of the auction area could well be managed by the local user group or Fishery Committee, carried out by association employee(s) paid for by association membership fees or operating income.

**Mirissa Auction Floor**

# SECTION IV: URBAN FISH HANDLING AND QUALITY

## 4.1 THE URBAN WHOLESALE MARKETS

The wholesale market in Colombo was visited during development of this document. The market actually operates as a wholesale market from 3:00 to 6:00 a.m. and then accommodates retail purchases from 6:00 to 9:00 a.m.

**Colombo Fish Market Stall**

The Colombo market is inadequate for the scale of business conducted in it. Access roads are very poorly maintained and narrow, parking is limited, and there are no operating sanitary facilities for the hundreds of users of this facility. No running water or wash water facilities were noted, and the market has no provisions for runoff control or waste collection. Floors are not graded or channeled for drainage, so old ice melt and fish fluids form deep puddles throughout the facility. These areas are not cleaned on a daily basis. Use of ice in fish displays is very limited. Ice is available for sale, but none was observed to be purchased during the visit.

GoSL discussions have recently been held to consider construction of new and better wholesale fish markets in urban distribution areas (G. Piyasena, *personal communication*). It is not clear whether this decision hinges on the desire to provide a better market or on the attraction of using the prime land the existing market is on for other purposes. Nevertheless, construction of a new and improved market will serve a significant need.

## 4.2 CONSUMER INFLUENCE

Lack of consumer awareness was cited in several interviews (P.H. Piyadasa, S.A. Sahabandu, and A. Premaratne, all *personal communication*) as a critical factor in creating a market for higher quality fish than are currently provided in Sri Lanka. Discussion in subsequent interviews elicited agreement in principal that there is a ready market in Sri Lanka for fish of poor quality primarily because the consuming public knows very little about how to judge fresh fish products or about the potential health

effects of consuming poor quality fish. The judgment persists that until the public consumer is educated and makes enlightened shopping decisions, little pressure will be exerted on the fish supply chain to make the effort needed to produce higher quality products. They currently sell all they can produce regardless of quality, and the retail price differential is said to be slight.

## 4.3 RECOMMENDATIONS

*Recommendation 4.1*
Construction of a new wholesale market will provide an opportunity to introduce modern concepts of sanitation and quality control that are probably impossible to impose in the existing facilities. Responsible officials should take advantage of this opportunity by seeking and integrating design advice from fisheries, food science and quality control experts. Provisions should be made for adequate runoff from the market floor with channels for directing flow away from work areas to a waste collection and treatment system. Freshwater should be provided throughout the marketplace for sanitation and cleaning of fish as well as tables and other facilities. Features to cool and keep fish fresh should be integrated into planning based upon expert input. Provisions should be made for daily cleaning of the market after each business day. Market managers should require and assure that users comply with operating procedures imposed to preserve product quality so that the market may cultivate a reputation for high quality products. With appropriate planning and implementation, the new market could serve as an example to other market development projects and as a source of public education. This would be preferable to simply building the new market on the same traditional basis as the old, in which case it may be expected to soon degrade to a condition similar to the existing market.

*Recommendation 4.2*
Fisheries Food Science and Quality Control should be added to vocational training curricula. Graduates may provide a cadre of appropriately trained technicians, who also might play a strong role in public education efforts.

*Recommendation 4.3*
A public awareness campaign should be launched to educate the consuming public about fish quality issues, including *why* the purchase of good quality sea food is important to them and their family's health, and also *how* to judge seafood quality they are considering for purchase. The campaign should also include post-purchase handling for preserving quality. Adults should be targeted in this campaign, perhaps by traditional communication techniques such as erection of billboards in strategic locations, pamphlets, classes, and similar methods. School children should also be targeted by introducing the required concepts in school curricula, and perhaps by developing appropriate children's literature, such as comic books, which have been successfully used in the Philippines. It might be suggested that MFAR be the focus of this effort, but other options may be judged superior by local authorities. In any event, this effort could and should involve several agencies and stakeholder groups.

# SECTION V: MULTI-DAY VESSEL TURN AROUND TIME

The time required to unload and provision a multi-day fishing vessel bears directly upon its potential profitability. The less efficient this process and the longer the vessel must remain in port, the less time is available for fishing and the lower its annual productivity will be. The typical multi-day vessel turnaround time in the fishery harbors is approximately one week, according to several boat owner interviews.

A boat whose typical fishing trip is ten to fourteen days long, e.g. a tuna longliner, whose turnaround time in port is one week can make approximately 18 trips per year, with 18 full weeks occupied in port. If the turnaround time can be halved, nine weeks of fishing may be added to the schedule, or approximately an additional five fishing trips per year, representing 28 percent more fishing time. Assuming all else is equal, this may equate to a 28 percent increase in vessel revenues.

A vessel making longer, four-week trips with a one week turnaround time can make approximately ten fishing trips per year. If his turnaround time can be halved, he adds 35 days to his fishing time, or an additional full trip per year.

Vessel servicing operations in the fishery harbors are currently inefficient for a variety of reasons. Several high priority causes are discussed individually in the following subsections.

**Rafting 3 1/2s at Mirissa**

## 5.1 PORT CAPACITY

Fishery port facilities are currently over subscribed. This is partly due to the physical capacity and docking structures available, but it is exacerbated by the inefficiency of operational infrastructure, which results in vessels remaining longer in port than they would if these inefficiencies were overcome. Resulting port crowding creates multi-vessel rafting at the docks, rendering vessel servicing difficult. Unloading fish, or providing fuel and water to a boat rafted fourth from the dock is difficult and labor intensive, while it also disrupts servicing operations in boats ramped closer to the dock.

**Rafting Multi-Day Vessels at Mirissa**

In fact, servicing of vessels rafted third or fourth from the dock appears to not occur, with these vessels simply having to wait while the vessels closer to the dock are serviced and vacate their dock space. Limited transfer of fuel and drinking water using hoses to these more distant boats is sometimes accomplished, but this does not appear to reflect the normal operational reality.

## 5.2 REFUELING FACILITIES

**Fuel Pump at Mirissa**

Multi-day boat owners report that refueling with diesel fuel frequently requires two to three days for a vessel to make its way to the limited refueling facilities and take its turn at the pump(s). The fishery port at Dondra has one operating fuel pump. Mirissa has two but only one is operational due to tsunami damage, and Hikkaduwa has only a single fuel pump (USAID 2005). The Dondra port services 346 multi-day craft, while Mirissa services 128 and Hikkaduwa 100 (USAID 2005). In addition, each serves an unknown but substantial number of 3½ ton vessels, which also require diesel fuel. The refueling facilities currently available clearly limit the efficiency of refueling this large number of vessels.

**Fuel Pump at Dondra**

## 5.3 FRESH WATER

"Fresh" water is required for drinking water while vessels are in port and to replenish supplies prior to departure on next fishing trips. It is also required for the sanitary washing of fish and for washing vessels, holds and equipment.

**Hikkaduwa Potable Water Tap**

The Mirissa port has eight taps supplying potable water for a fee of Rs 0.20/liter, but the Hikkaduwa port has only one. The water tank supplying the Mirissa taps, however, is only filled for three to four hours each day, limiting the supply that may be dispensed through the eight-tap system. Even when it is available, however, fishers frequently do not avail themselves of this supply for rinsing fish or equipment. Many prefer to rinse the fish with seawater drawn by bucket from the harbor. This water is frequently extremely filthy, but some fishermen prefer this to freshwater as they believe it firms the fish more than does freshwater. Also, the dirty harbor water is free, while the potable water has a cost.

### 5.2.1 Drinking Water

A supply of drinking water is essential for provisioning a multi-day boat. Because of the fee charged for fishery port water, however, some owners and crews tend to skimp on the supplies they take. Others do not use the port facilities, preferring to find water elsewhere at lower cost, even though this may require more effort and time.

Complaints were also common concerning the volume flow capacity of the existing dispensing systems, indicating that pipe and hose diameters may be small, or water head may be slight. The single tap at the Hikkaduwa port was a notable target of this criticism, where the tap is immediately adjacent to the diesel fuel pump, which would allow concurrent watering and fueling, except that this advantage is largely lost because of the slow flow of water from this supply.

### 5.2.2 Wash and Rinse Water

Wash and rinse water does not necessarily have to be potable, but it must be clean. For example, it may be saline, but it should not be contaminated. Some of the drinking water wells near the fishery harbors are said to be periodically subjected to salt water intrusion, limiting their capacity for providing potable water. This brackish water is presumably clean, however, because it percolates through the ground on its path from the sea to the well. If this is true, this water supply may be well suited to washing fish and fishing equipment, making use of an otherwise unusable resource while freeing the supply of potable water for human use.

Saline ground water might also satisfy the bias of fishers against using fresh water for washing their fish catch, thereby promoting improved hygiene and raising the quality of fish product passing through the harbor.

## 5.3 ICE

Ice availability is a significant issue affecting vessel turn around time. Sri Lanka produces about 1,400 MT of ice per day. Assuming a need of one kg of ice to one kg of fish production, this supply should be sufficient for the 1,300 MT of fish produced each day. Unfortunately, the distribution of ice plants does not always coincide with distribution of fishing effort, which causes supply problems and delays in many areas (H. Kitani, *personal communication*). This problem was accentuated by the tsunami.

At Hikkaduwa, for example, four ice plants were destroyed by the tsunami (USAID 2005), leaving only one operating plant in the area. This plant has a capacity of only 100 to150 blocks per day (USAID 2005) to 350 blocks per day (local fisher interviews). Each multiday boat requires a supply of 150 to 200 blocks for a trip, however, so even at best this local plant can supply only one to two boats per day. The price for ice in Hikkaduwa is reported as Rs 140 per 50 kilograms, whereas in Mirissa and Dondra it is only Rs 100 per 50 kilograms. The restricted supply at Hikkaduwa presumably allows this

differential. Fishers at Hikkaduwa are able to purchase ice from other locations, even as far away as Colombo, but they must pay substantial delivery fees, and delays of several days to a week are common.

Ice plants in the Mirissa area produce 45 tons per day (USAID 2005), equivalent to 900 50-kilogram blocks per day. This is sufficient to supply six to seven multi-day boats per day, but fisherman interviews at Mirissa indicated that provisioning ice for a fishing trip typically requires three to four (or more) days. The Dondra harbor is supplied by a combination of one ice plant in the harbor, another about a kilometer away, and two others in Matara. These are considered insufficient by harbor managers, however, who have reported a need to construct a 25 ton/day plant in the harbor area (USAID 2005).

## 5.4 BOAT MAINTENANCE INFRASTRUCTURE

Repair and maintenance services for vessels are inefficient and prolong turn around times at the fishery harbors, because few qualified technicians are available. Owners informed us that only two engine mechanics, one electrician, and one fitter are available to service boats at the Mirissa Harbor. Other owners reported that Hikkaduwa has only a single "qualified" mechanic with owners either competing for his services or resigning themselves to employing services of one or two other poorly qualified mechanics working there. It appears that additional employment opportunities in these vocations exist to service the fishing fleet, and that vessel turn around times will readily benefit if qualified mechanical and electrical services are made more readily available.

**Net Mending at Mirissa**

## 5.5 NET MENDING

**Net Mending Backlog at Hikkaduwa**

Fishing nets must frequently be repaired between fishing trips by mending rips and holes, and replacing or repairing lines, weights, or floats. Not all vessels require nets to be mended between all trips, but when mending is required it has the potential for affecting turn around time.

All three of the ports visited have a covered net mending area, but owners interviewed at all three ports reported that facilities are insufficient for the number of nets needing repair. Each facility is said to have a backlog of two to five days of work, meaning that vessels requiring these repairs must wait for at least this long for

repairs to be made. The addition of floor space square footage devoted to net mending and provision of trained labor would speed turn around time for most vessels between some trips.

## 5.6 FISHER AMENITIES

The fishery harbors of Puranawella (Dondra) and Mirissa have small canteens where fishers may obtain refreshments, but no such facility is available at Hikkaduwa. None of the harbors have adequate sanitary and wash facilities for fishing crews. None appear to have medical facilities for providing first aid for injuries or other medical care.

None of the three harbors has facilities for provisioning food or sanitary supplies to vessels preparing for their return to sea. These supplies must be obtained elsewhere and brought to the vessels. More organized owners schedule delivery of provisions to the vessels, while others make arrangements to purchase supplies elsewhere as their custom dictates.

## 5.7 FISH UNLOADING

Fish unloading times and scheduling are problematic in regard to vessel turn around time. These issues are discussed in Section 3.1 of this document.

## 5.8 DOCK FEES

Sustainability of services provided to fishers will to some degree depend upon revenues generated to support them. A nominal fee is currently charged to the fishers using the fishery harbors for access and use of jetties and other harbor facilities based upon the length of the vessel, but the fee seems to not be conceptually connected to amenities and other services. The Mirissa dock fee schedule is presented as an example in Table 2, and fees at the other harbors are comparable.

**Table 2.**
**Dock Use Fees at the Mirissa Fishery Harbor**
**(USAID, 2005)**

| Boat Length (ft) | Fee Rs/month | Fee US$/month |
|---|---|---|
| 28 | 230 | 2.30 |
| 30-34 | 460 | 4.60 |
| 35-39 | 690 | 6.90 |
| 40-44 | 920 | 9.20 |
| 45-49 | 1,150 | 11.50 |
| 50-54 | 1,380 | 13.80 |
| 55-60 | 1,800 | 18.00 |

Interviews with numerous boat owners indicated a ready willingness to pay higher use fees if the fees are tied to the provision of additional infrastructure supporting services needed by the fishers. It appears universally recognized that the added fishing time enabled by a more efficient vessel turnaround will easily recoup reasonable additions to the use fees.

## 5.9 RECOMMENDATIONS

*Recommendation 5.1**
Vessel refueling capacity should be increased at all three harbors. Furthermore, the refueling area should be segregated from the fish unloading and auction areas to avoid contamination of fish with petroleum products. Unloading of fish in this area should be prohibited. Multiple fueling stations should be provided in adjacent vessel berthing areas. High capacity pumps should be installed and fitted with hoses long enough to reach the second rafted vessel from the dock. Vessels should be expected to leave the fueling stations shortly following completion of refueling to allow waiting vessels to obtain fuel. Harbor managers should consider the fueling zone as a service area occupied only as long as necessary to complete the service of refueling.

Three fueling berths are recommended for each of Mirissa and Dondra, while two berths may suffice for the smaller Hikkaduwa harbor. Small curbs or berms should be installed around the pump areas to contain spills and avoid harbor contamination from fueling operations.

*Recommendation 5.2**
The capacity to provision vessels with potable water should be centralized, preferably in the same areas as refueling facilities are installed. Vessels should be able to load fuel and potable water at the same time and place. The water supply should provide reasonably high volume flow to avoid unnecessary provisioning delays. Water supplies should be configured to serve the same berths as used for fueling.

*Recommendation 5.3**
A second water system should be installed for free access by fishers to wash fish and equipment throughout the harbor area, but this should not be potable water. The supply for this system should be brackish water taken from a simple local harbor well to the seawater table, designed to extract seawater that has percolated through the ground. This water should be analyzed for chemical contaminants such as hydrocarbons and cleaning chemicals, and for fecal contamination, but nutrient levels should be of little concern. It may be brackish to even seawater salinities, but it must be free of contaminants capable of degrading fish quality.

This system should provide multiple readily accessible taps and hoses at all docking facilities to encourage its use. Costs for maintaining this system should be recouped from docking fees so that no direct cost for this wash water is perceived by fishers or boat owners. Its use should be encouraged, especially for washing fish, which are now

frequently rinsed with dirty harbor water. The fact that this water is saline should overcome fisher reluctance to use fresh water for washing the fish.

*Recommendation 5.4*
Dock User Fees should be raised to cover costs of maintaining the water and refueling systems. In addition, Harbor Managers should consider including the cost of potable water to provision multi-day boats in the Dock Fee to encourage use of the system. An estimate of the volume used by the typical multi-day boat can readily be made, and the average number of trips per vessel may also be made, leading to computation of the cost of supplying the average multi-day boat per month. This may then be added to the Dock Fee.

Once the water system is in operation, records must be kept concerning which vessels use the facility with what frequency, in order to avoid system abuse. Attention to such details will potentially eliminate the alleged practice followed by some boat owners of registering only two to three vessels, while using facilities for more than this number (USAID 2005). Equity among fishers should require that each vessel pay its own full Dock Fee.

*Recommendation 5.5*
Vocational training of qualified boat engine mechanics, fitters, and electricians should be pursued with a high priority for crew safety reasons as well as to enable more rapid turn around times at dock. A lack of technicians can result in boats leaving the dock without proper maintenance. No Sri Lankan national capacity exists for assisting disabled boats at sea, so unless they are able to summon assistance from other fishers by radio, their safety may be at risk. Vocational training will help avoid such situations, will reduce vessel turn around time in port, and will provide trainees with new and valuable employment opportunities.

Discussions indicate that some such training may be possible within the SLTRP as currently conceived. If so, curricula responding to these needs are encouraged.

*Recommendation 5.6*
Facilities dedicated to net mending at the Dondra, Mirissa and Hikkaduwa fishery harbors are good but of inadequate size. The demand for net mending services results in a constant three to five day backlog, delaying vessels turn around. Additional floor space would be helpful, even to doubling the floor space currently available. A second story built on the existing foundations might be considered if a means for efficiently and mechanically hoisting nets to that level can be devised.

Addition of net mending floor space may also provide opportunities for additional employment of net menders.

*Recommendation 5.7*
A small mobile crane system is recommended for lifting containers of fish from boat decks to the dock. The containers may consist of boxes or even merely net bags.

Existing boat configurations will probably require the continued practice of removing one fish at a time from the hold to the deck, but once there, the fish may be removed from the deck in small lots using the crane system. The objective is to enable more rapid unloading from dockside vessels, but also to enable ready unloading from vessels rafted two or three vessels deep at the dock. The containers may be lifted directly to scales on the dock or into small wheeled trailers or trolleys capable of being taken directly to the auction area to speed transport of the fish to appropriately iced auction facilities.

Interviews indicated some fisher reluctance to this kind of change, mostly on the basis that they sometimes do not desire rapid unloading if the auction price is too low. They sometimes prefer to delay unloading until the price rises. This reluctance probably demands that a participatory process be employed to develop consensus regarding vessel unloading improvements. The mere presence of unloading equipment does not prevent a boat owner from delaying unloading, but in the present system, if the owner of the first boat at the dock wants to delay, then other boats rafted outside his must also wait. With a crane system, the outer boats may still unload if they wish, and speed their turnaround time to go to sea again. A participatory process may ease the transition to improved dockside fish handling.

*Recommendation 5.8*

An evaluation of the ice supply situation at the several fishery harbors from the perspective of the fishers would help to determine whether the supply is not only adequate, but whether it is adequate *in time*. Time wasted at the dock is lost fishing time, which becomes lost revenue. If a fisher making an average of 18 trips per year has to wait two extra days for ice each time in harbor, he is losing 36 fishing days, the equivalent of one to two entire fishing trips.

Recommendations provided by USAID (2005) suggest that ice production should be left in the hands of private enterprise, which should work well except in cases where a monopoly on ice production exists. In a captive market, higher prices can be justified, such as were noted in Hikkaduwa. When needs are identified, efforts should be made to avoid monopolistic or price-fixing situations by encouraging competition among ice providers.

Another alternative may be to encourage ownership of ice production capacity by Fishery Committees or local fisher cooperatives, who may retain profits to the benefit of members, and who may be able to exert pricing competition on private enterprise. These concepts are discussed in further detail in Chapter 8 of this document.

# SECTION VI: ONE-DAY FISHERY

The one-day fishery refers to boats that fish for only one day at a time, returning to land each day to sell their catch. It consists of traditional boats, FRPs, and 3½ ton inboard engine vessels. The latter are capable of staying out longer than one day, but they usually have no ice-holding facilities other than insulated foam boxes they may take along. Some 3½ owners install an ice hold, however, to fit them as "tank boats" that may stay out three to five days. In the latter case, they become part of the multi-day fleet. Most of the one-day boats have a crew of two fishers, who share in proceeds from the catch.

Indications are that the coastal one-day fishery was showing clear signs of over exploitation even before the tsunami (MFAR 2005). Catch and effort data also indicated over-exploitation (Amarasingh 1999). Although verifiable numbers are difficult to secure, reports are that relief efforts have added significantly to this fleet (G. Piyasena, *personal communication*; A. Premaratne, *personal communication*), presenting a risk of even greater overfishing, potentially endangering this fishery.

Catches per unit effort are already somewhat low in this fishery, with the average daily catch for an unmechanized traditional boat being approximately eight kg (A. Premaratne, *personal communication*). Assuming a favorable price of Rs 150/kg for the entire catch, which is optimistic, this would provide income of Rs 1,200/day (US$12.00) to be split between two hard working fishers and their families. It is reasonable to expect that if more boats are added to this fishery, the average catch per unit effort will decrease, further lowering per boat income.

## 6.1 FISH HANDLING

One-day boats typically leave land at about 4:00 or 5:00 p.m., travel three hours out, fish for six hours, and travel three hours in. They fish all night and sell their night-caught fish in the early morning hours at established landing areas. The fishery harbor sales floors serve a significant part of this fleet. There are perceptions among one-day fishers, however, that they are being shut out from harbor services in favor of multi-day boats. This appears to be an unintentional result of overcrowding among port users in general, with even multi-day vessels experiencing difficulty in accessing port services.

One-day fishers hold their catch in plastic or foam boxes; some use a small amount of ice in the boxes, but many do not. Fish too large to fit into the boxes are simply kept on deck until landing.

The one-day fishery provides a great variety of species to the market, and a significant portion of their catch is sold immediately to local consumers in the early morning after it is caught. The quality of the fish carried away by these consumers is generally of reasonably high quality. Another portion of this catch is purchased by resellers. Some of these carry their fish by bicycle to established residential customers, with the fish carried in a box mounted on the bicycle. Ice is not usually carried in these boxes because the ice adds weight and takes up space that can be used for product. Nevertheless, these fish

typically find their way to consumers rather quickly, and reasonably good quality to the consumer is probably the norm. Another portion of this catch finds its way to street and stall vendors, who display the fish on shelving without chilling or ice. The larger of these display only a small portion of their stock, replacing sold product with reserves stored on ice. Many street vendors, however, do not have such facilities, and the fish lie on the unprotected shelves until they are sold, sometimes in a degraded state.

Wholesalers also purchase larger lots of these fish at dockside auction. These fish are then transported to other areas and markets in trucks. Many of these trucks keep the fish on ice and are insulated; others are neither insulated nor use ice, resulting in variable quality, as discussed elsewhere. Some of these wholesale lots are transported to larger wholesale markets such as in Colombo, where they are resold in smaller lots, some of which actually find their way back to roadside retailers nearer their point of original landing.

## 6.2 RECOMMENDATIONS

*Recommendation 6.1*
One day fishers should be included in stakeholder groups developed in fishery harbor areas, so they may share the organization's voice in harbor services and management, and to encourage their access to future fisheries extension training opportunities. Membership fees for these small-boat owners should be lower than for multi-day boat owners.

*Recommendation 6.2*
Small areas of the dock should be set aside for use only by one-day boats, which can more quickly load and unload than can multi-day boats. Delays caused by waiting for multi-day boats to clear space for the smaller boats are unnecessary and maybe avoidable by well managed dedicated small boat areas. Floating docks installed at a right angle to seawalls may provide an option for accomplishing this objective.

*Recommendation 6.3*
It is appropriate to consider managing the one-day fishery on a limited entry basis to counter over fishing and declining catch per effort pressures. Interviews elicited opposing opinions concerning whether the ability to register and monitor fishing vessels is in place. If it is in place, or if it can be effectively developed, it appears appropriate to abolish new entries to this fishery, and perhaps to limit inheritance of boat registration privileges, which would cause the one-day fleet to gradually downsize. This should result in improved potential for sustainability of the fishery and ultimately in increased catches per unit effort.

*Recommendation 6.4*
NGOs and other donors should be discouraged from donating more canoes and other one-day fishing craft to replace tsunami losses. The coastal fishery is at risk from over fishing, and donations are increasing the number of boats to levels higher than were employed prior to the tsunami. It would be more helpful to divert some of these

donations to other uses such as multi-day vessel alterations designed to increase product quality, or providing small ice plants or machines at one-day boat landings and servicing areas to encourage its use by the one-day fleet, or any number of other needs.

*Recommendation 6.5*

If political and diplomatic realities allow, it may be appropriate to consider a buy back program to counter the entry of excessive donated boats to the fishery in order to manage fishing pressure. It may be appropriate to buy back some of the older and worn boats in this fishery on a reasonable price scale while providing one of the new donated boats to the fisher at no cost to him. This would direct the new boats to long-established fishers who might benefit from receiving a new boat, while diverting the new boats away from new and inexperienced fishers, some of whom should probably not enter the fishery anyway.

# SECTION VII: FISHER TRAINING

Great enthusiasm exists among fishers and boat owners for practical vocational training. All interviewed boat owners responded affirmatively that they would encourage their crews to attend training sessions. Fishers unanimously responded affirmatively, indicating they would readily avail themselves of training opportunities. Unfortunately, no effective fisheries extension service exists in Sri Lanka. Vessels previously used for fisher training are reported to have been destroyed by the tsunami (O. Amarasinghe, *personal communication*). Potential subject areas for training include, but are certainly not limited to, the following:

- Improved fishing technologies and methods
- New equipment, such as navigation and fish finding gear
- Improved at-sea fish handling leading to higher quality landings
- Dock side and auction fish handling
- Export product requirements and EU regulations
- Business and personal money management (including spouses)
- Safety at sea

Teachers, lecturers, and workshop leaders could be recruited from a number of sources, including MFAR, NARA, universities and relevant NGOs.

## 7.1 FORMATS

Owners and boat owners all agreed that training sessions would be most effective and would elicit greatest participation if the training sessions were kept short and were conducted at the fishery harbors. Full- to multi-day commitments to attend long training courses would be difficult to achieve. Similarly, travel needed to attend training would prohibit participation by many.

Training sessions should therefore be no longer than one to two hours long and should be held on site at the fishery harbors. Furthermore, they should be repeated several times at each site to enable maximum participation. Fishers come and go to sea, and repetition will allow them to attend while in port by accommodating a variety of fishing trip schedules.

## 7.2 ADMINISTRATION

That fisheries extension training is needed is without question, but the most appropriate administrative structure for providing this service is not quite so clear. Obvious candidates are NARA and the university system, which are primarily research institutions whose findings and research should find their way into extension training materials. Despite their orientation toward university level training, management of mundane vocational training through research institutions has demonstrated mixed results, depending on staff motivation. MFAR and DFAR are also candidates for implementing

fisheries extension services, but the organization of these services within these agencies requires further deliberation.

Another possibility exists within the SLTRP, which includes establishment of permanent vocational training facilities, possibly including maritime training. If this notion continues to fruition, this facility might be a natural parent to fisheries extension training in the fishery harbors.

## 7.3 RECOMMENDATIONS

*Recommendation 7.1**
A participatory process should begin immediately to design an administrative structure for providing fisheries extension services to the fishery harbors of Puranawella, Mirissa and Hikkaduwa as a demonstration project. Demonstrable success will enable expansion of the program to other areas and facilities. The process for designing the system may best primarily include administrative stakeholders, but at a minimum final decisions should be vetted by representative user groups, such as boat owners and fishers.

The development process may be driven by NGO enablers or other outside experienced mentors, but it must involve all stakeholders potentially contributing to training or to the management of the process. A government commitment to sustainability and funding of the extension program should be sought.

This program should be initiated as a very high priority. Extension education is the best immediate opportunity for altering fisher behavior to raise fishery product quality, and consequently to raise incomes and provide higher quality product to consumers. It can be implemented by first incorporating training subjects common to all fisheries, and later it may incorporate results of demonstration projects recommended elsewhere in this document. Instruction subjects and expertise should be drawn from all available sources, including NARA, universities, CEY-NOR, MFAR Quality Control departments, private industry exporters, NGOs and others. Instructional priorities should be developed in consultation with user stakeholder groups.

Extension outreach should also include training opportunities for Harbor Masters and Assistant Regional Fisheries Directors, who have demanding job responsibilities for which they are not always prepared and who will profit from learning specific to their roles. In these cases, however, extension education does not necessarily have to be limited to short sessions at the harbors. It may be more appropriate to periodically gather these officials in a central location such as Colombo to provide them with more intensive and focused training opportunities.

Certificate recognition should be considered for all trainees to generate pride and sense of accomplishment, as well as providing a means for demonstrating competence in new potential employment situations.

*Recommendation 7.2**
A mobile training facility should be designed and constructed as a high priority action of the fisheries extension apparatus derived from Recommendation 7.1. This capability will allow extension training to be offered at multiple sites on multiple occasions with a high degree of flexibility and effectiveness. The facility may consist of a truck with either a fixed body or a container-type trailer containing all equipment and training materials. Classes could be conducted on auction floors, in rooms available at the harbors, or directly outside the mobile facility itself. Roll-out awnings mounted on the sides of the mobile facility would provide shelter, and arrangements may be made for incorporating marker boards, projection equipment and screens, and other training aids as necessary. Folding chairs and tables should be carried in the facility for on-station use. This is not a unique proposal, as similar facilities have been used elsewhere, and have proven very effective.

*Recommendation 7.3*
Alternatives for providing extension services on training vessels should be evaluated. It has been reported that fishery training vessels were destroyed in the tsunami, and replacement of these vessels should be considered by extension officials, but alternatives should also be considered. An on-board training capability can sometimes be very effective and important, but ownership of the vessel may not be a necessary expense. An alternative is to rent or lease vessels from fishermen in instances where they are required.

# SECTION VIII: STAKEHOLDER PARTICIPATION

Organization and active participation of local fishers and other stakeholders is a critical component of any fisheries improvement process. In the case of the Dondra, Mirissa and Hikkaduwa Fishery Harbors, fishers using the facility can provide valuable input toward sustainable management of the facilities, and fisher resources may frequently be mobilized to provide important operational participation. In addition, the sense of participation provides critical underpinning to stakeholder acceptance of management changes and strategies. Increasing catch, improving product quality, streamlining fish handling, and otherwise enhancing the fisheries value chain will be greatly facilitated if effective and committed stakeholder groups are mobilized to participate in development partnerships.

Local fisheries groups have a history of stakeholder involvement, including fisheries cooperatives and "Landing Site Committees," indicating organizational ability and acceptance of participatory concepts. In addition, the Fisheries and Aquatic Resources Act of 1996 (Part IV, Paragraph 32) provides that "Registered fishermen residing in or engaged in fishing in each fisheries management area or part thereof . . . may form themselves into a fisheries committee." It further provides that the functions of a fisheries committee shall include:

- "formulating a fisheries programme for its area and implementing that programme
- assisting its members to obtain boats, gear, and equipment to be used in fishing operations
- carrying out social infrastructure and welfare activities with a view to improving the living standards of the fishing community of that area; and
- engaging in such other activities as are approved by the Director [of Fisheries and Aquatic Resources] as beneficial to the fishing community of the area."

The act specifies that upon formation, the fishery committee shall function as a corporate body, with certain reporting and accounting requirements. It is not known but to be hoped that the corporate format also provides personal liability protection to its officers and agents under Sri Lankan law.

An effectively operating stakeholder group, or Fishery Committee, can perform numerous invaluable functions relevant to improvement of the fisheries value chain, some of which are discussed below.

## 8.1 PARTICIPATION IN PORT MANAGEMENT

An operating Fisheries Committee ("Committee" hereafter) comprised of port users has a unique perspective concerning operational aspects of the facility. Committee members have a vested interest in the port's efficient operation, availability of relevant services, and long-term sustainable maintenance and operation.

A strong Committee operates as a two-way communication conduit, providing suggestions and input from its user-members, and providing liaison for dissemination of harbor management decisions and policies. It forms a nucleus that may be mobilized to organize extension training, and for facilitating communication between members and other interest groups. It can help focus consumer education efforts, as well as campaigns to inform government policy-makers regarding mattes of stakeholder interest.

## 8.2 PORT SUPPORT SERVICES

A Committee operating as a corporation may create earnings, hire employees, and provide services. There are certain fishery harbor support services that would benefit all fishers if they were provided, but for which little incentive currently exists to encourage anyone to provide.

Maintenance of fish auction areas provides an example. In the current operating scheme, it appears that responsibility for cleaning fish auction areas remains unassigned and is therefore not practiced. If raised fish display tables and ice are provided in the auction areas, as recommended elsewhere in this report, it would be appropriate for the Committee to undertake responsibility for maintaining this "common" area by hiring a person to clean the tables and provide fresh ice for each market day.

Indeed, it may be appropriate for the Committee to have on-site ownership of the limited ice-making capacity that would be required for the auction areas, and that expenses for this common area maintenance activity might be met by membership dues levied on all members of the Committee.

Similarly, if ownership of diesel fuel tanks and pumps can be negotiated with harbor management to invest ownership in the Committee, the Committee could undertake to manage this service and to collect profits from fuel sales. The Committee would also in this case have an opportunity to reduce its profit and lower the price of the fuel to the fisher-consumer, thereby providing assistance to the consumer while rendering a tangible benefit to its members. The Committee would, of course, have responsibility for arranging fuel deliveries to the harbor and other maintenance of the fueling facilities.

A similar arrangement might be possible for the potable water supplies, leading to a reduction in cost to the boat owners and fishers.

Savings such as these may well justify costs of stakeholder membership in the Committee.

Activities such as these have the potential for raising the quality of fish leaving the fishery harbors and for reducing the turn around time for multi-day fishing vessels. They therefore can contribute to improving the fisheries value chain by increasing revenues to fishers and boat owners alike.

## 8.3 FINANCING ASSISTANCE

An effective Committee may provide an effective conduit for government or NGO subsidies, grants, and other financial aid mechanisms, just as the Sri Lankan fishery cooperatives did during previous years, when fishers needed assistance to mechanize their boats. A financially viable Committee can also assist members to obtain financing from other financial institutions, and even provide financing itself if strong enough.

This assistance may prove invaluable to aid fishers in financing changes in their boats to improve catch quality, such as shelving systems in fish holds or chiller units, as discussed elsewhere. It may also be of service to help finance changes in fishing technology, such as in shifting from drift gill nets to long lines.

## 8.4 FISHER WELFARE

In addition to the assistance Committees may provide to improve the fishery value chain, they are well placed to tend to the welfare of their members, leading to an improved quality of life for fishers and their families.

If a Committee develops associations with banking institutions or even establishes its own credit union, it is positioned to assist fisher families with financial management planning, saving, and consumer education.

If Community Centers are in the future for the fishery harbor areas, established Committees may play active roles in their development and management.

They are also highly qualified and have a vested interest in lobbying for regulatory and policy changes benefiting their members, such as fisher-boat owner employment agreements or contracts, developing requirements and enforcement for vessel safety equipment, changing labor laws so that fishers may receive the same social security and insurance privileges enjoyed by employees in other industries, development of capabilities for at-sea rescue and assistance, pressing for relevant provisions of the International Labor Organization's Fishermen's Articles of Agreement Convention of 1959 (ILO 2005), and numerous others areas of concern or interest.

## 8.5 RECOMMENDATIONS

*Recommendation 8.1*
Fishery Committees in the fishing ports of Dondra, Mirissa and Hikkaduwa should be assessed concerning their levels of present organization and activity. If inactive or languishing, they should be encouraged to organize and become engaged. A candidate issue that may be used to encourage initial activity is the need to organize extension training events. A fledgling Fishery Committee might be encouraged to assist in establishing training subject needs, scheduling events, publicizing training events, and assisting in logistical support. This initial activism might then be nurtured to gradually undertake other initiatives deemed appropriate and needed.

*Recommendation 8.2*
The potential for vesting the Fishery Committees with ownership of renovated or new diesel fueling facilities in their respective ports should be evaluated. If ownership of these assets can be achieved, fuel sales could provide an important mechanism for funding other activities of the Fishery Committee, including providing management services for some of the common area facilities. In such case, Fishery Committee management should be expected to undertake total management of the fueling facilities, including contracting for fuel deliveries and cleaning and maintenance of fuel tank and pump areas.

*Recommendation 8.3*
If Recommendation 8.2 can be achieved, the Fishery Committee should seriously consider lowering the diesel fuel price from their pumps to a level below normal retail prices, but leaving a reasonable profit for the Committee. This strategy would certainly be perceived as a value provided by the Committee to its members, leading to a stronger support constituency.

*Recommendation 8.4**
If improvement of harbor fish auction floors is achieved, it would be most appropriate to operate them as common areas, owned by no one but used by all. In this event, it would be appropriate for the Fishery Committee at each harbor to undertake operational support and maintenance of these facilities whose principal users are all of the Committee's members. This would include daily cleaning of the facility, and depending on what kinds of improved facilities are installed, may include the need for supply and replenishment of ice to fish display tables during auction operating hours, or for electricity and maintenance for cold room facilities.

Denoting this and associated recommendations as candidates for rapid implementation (asterisk) assumes that Fishery Committees readily embrace the underlying concepts and are sufficiently well organized to execute the needed tasks. Assessment of this assumption should be undertaken prior to committing resources to these actions.

*Recommendation 8.5**
In order to support Recommendation 8.4, small scale ice-making equipment owned by the Fishery committee should be installed adjacent to the fish auction floor. It should be used to only supply common area ice requirements, to assure proper cooling of fish displayed for auction. This small capability should not be used to provide ice to vessels in competition with other ice suppliers, as such activity would soon overwhelm capacity and undermine the primary purpose for installing the equipment in the first place. This policy would also serve to assure private sector ice suppliers that the facility is not providing competition for their activities, hopefully avoiding their opposition to the small auction floor facility.

*Recommendation 8.6*

To help support Recommendations 8.4 and 8.5, dock use fees charged to each boat should be nominally raised, with the added funds being transferred to the Fishery Committee to pay employees required to provide auction floor services and to cover costs of the operation.

*Recommendation 8.7*

Funding should be sought to provide mentoring and encouragement to the Fisheries Committees for an extended time of several years. Development and operational progress is likely to be, and probably should be, stepwise, demonstrating incremental strides in assuming responsibility and development of programs and influence. Sustainable development of effective Fisheries Committees requires that developmental support not be withdrawn prematurely.

# ANNEX A: CITATIONS

Amarasinghe, O. 1999. The economics of a fishery and optimal resource use. Mimeographed fact sheet, Dept. of Ag. Economics, Univ. of Ruhuna, Sri Lanka.

Amarasinghe, O. and A. Premaratne. 2004. Identification and Analysis of problems associated with the Fisheries and Aquatic Resources Sector, pp. 33-67 *In* Draft Fisheries Management Policy for Sri Lanka. Draft MSS.

DCS. 2005. Food Balance Sheet compiled by Sri Lankan Department of Census and Statistics. *after* MFAR, 2005.

ILO. 2005. C114 Fishermen's Articles of Agreement Convention, 1959. International Labor Organization. Available on the Internet at: http://www.ilo.org/ilolex/cgi-lex/convde.pl?C114. [Convention not ratified by either Sri Lanka or the United States of America].

Kitani, H. 2005. Personal Communication. Advisor to Ministry of Fisheries and Aquatic Resources, Colombo.

Liyanaga, K.D. 2005. Personal Communication. Attorney at Law, General Manager, CEY-NOR Foundation, Ltd., Colombo.

Mahinda, H.W. Personal Communication. Home address: 131, Light House Road, Dondra.

MFAR. 2005. Strategy and Programme for Reconstruction and Development of the Marine Fisheries Sector. Colombo, November, 2005. 31 p.

Piyadasa, P.H. 2005. Personal Communication. Multi-day Boat Owner, Mirissa.

Piyasena, G. 2005. Personal Communication. Director General, Dept. of Fisheries and Aquatic Resource (DFAR), Colombo.

Premaratne, A. 2005. Personal Communication. Additional Director/Coastal Conservation, Ministry of Fisheries and Aquatic Resources (MFAR), Colombo.

Sahabandu, S.A. Personal Communication. General Manager, Ceylon Fisheries Corporation, Colombo.

USAID. 2005. Sri Lanka's Fisheries Sector: Opportunities for Assisting with Value-Addition in the Value Chain. USAID/Sri Lanka, August, 2005. 34 p + app.